

BREDDING SELECTION OF WAN STRAIN COARSE WOOL ANGORA RABBIT

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ABSTRACT

Adopting hybridization method of breeding, Wan strain coarse wool Angora rabbit, which is of high yield, high quality, and high efficiency, are incubated successfully by means of Germanic Angora rabbit crossing with White New Zealand rabbit after systematic breeding for 10 years. This rabbit is of medium body type. The body weight, body length, and chest girth of 11 months of age are 4258.3g, 51.9cm, and 33.5cm respectively. It grows relatively quick prophase. The body weight of 5 months of age is equivalent to 84.2% of adult. Wool yield and rate of coarse wool are all high relatively. Shearing hair capacity and rate of coarse wool of 11 months of age are 294.3g (equivalent to 1177.1g per year) and 15.9% respectively. The hair quality is fine. The length, fineness, intensity, and stretched length are 11.6cm, 47.0 μ m, 28.4g, and 47.3% for coarse wool fibre, 7.4cm, 15.6 μ m, 4.8g, and 45.4% for fine wool fibre of 11 months of age, respectively. Harvesting manner is not restricted, either shearing or plucking wool. The reproductive performance is moderate. The number is 7.21 for primiparous litter size, and 6.82 for live litter size. The birth weight, body weight of 21days of age, and weaning litter weight are 363g, 2244g, and 5027g, respectively. Survival rate at weaning is 91.7%.

Key words: animal husbandry, breeding selection, wan strain, Angora rabbit.

INTRODUCTION

The beginning of breeding a coarse wool rabbit was firstly initiated in 1982 at the Institute of Animal Science of Anhui Academy of Agriculture Sciences in allusion to the condition of absence of this kind of rabbit. We take on technology tackle key problem item about research and exploitation of coarse wool rabbit breeding and multiplication from 1986 to 2000. We incubate Wan strain coarse wool Angora rabbit successfully which is of Chinese characteristic and high yield, high quality, high efficiency. Authorize through the animals and birds of Anhui Province assortment in 2000.

METHODS AND MATERIALS

The research was conducted at the breeding rabbit farm of the Institute of Animal Science of Anhui Academy of Agriculture Sciences mainly. During the whole research stages, rabbits were raised and managed under the same condition, 100-150g pellet feed per day, 300-500g green-feed, feeding to appetite, drinking by the automatic

drinking bowl.

Breeding selection course and method

From 1982 to 1985, the innovative stage of crossbreeding included a first reciprocal crossing between German Angora rabbit and White New Zealand rabbit (coming from the breeding rabbit farm of Guzhen county of Anhui Province), then a backcrossing with German Angora rabbit (Figure 1). Ideal individuals of high relatively wool yield and rate of coarse wool began to appear in F₂ population.

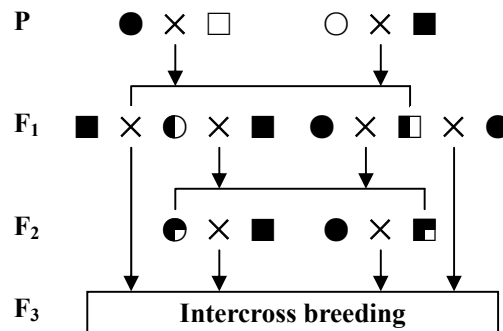


Figure 1: Crossbreeding scheme between German angora (● male; ■ female) and White New Zealand rabbits (○ male; □female) to create the Wan angora rabbit.

From 1985 to 1987 an intercrossing stage finalized the design. Intercross-breeding foundation populations were composed of ideal individuals selected from F₂ and F₃ generations. Ideal properties of population were stabilized down gradually for 3 generations of intercross and the design was finalized through mating system among crossbred.

The improvement stage of expanding population (1987-2000)

During this phase the main objectives was to increase the size of the population and to increase the quantity, and to improve the quality of the wool produced. Besides, it was also to progressively disseminate the breeding of the new strain to producers, examine breeding value during production, expand the quantity of the animal stock and distribution area, and adapt the strain to extensive conditions.

From 1987 to 1991, the foundation stock was set up by selection of individuals with a high rate of coarse wool, regarding improvement and stabilization of coarse wool rate as the main purpose, as well as improvement of wool yield. The methods adopted in this stage include selection and early mating from the age of 5 months, germ plasm evaluation combining visual fleece assessment and laboratory measurements, a comprehensive index, and individual and family synthetically etc. Rabbit production performance, especially rate of coarse wool, are raised notably, and steady step by step after it goes through breeding selection of 5 generation. The following selection indexes were used.

$$\text{Selection index at 5 months of the age: } I_1 = \frac{0.5P_1}{\bar{P}_1} + \frac{0.3P_2}{\bar{P}_2} + \frac{0.2P_3}{\bar{P}_3}$$

$$\text{Selection index at 8 months of the age: } I_2 = \frac{0.5P_1}{\bar{P}_1} + \frac{0.3P_2}{\bar{P}_2} + \frac{0.2P_3}{\bar{P}_3}$$

$$\text{Comprehensive selection index: } H = \frac{0.4I_1}{\bar{I}_1} + \frac{0.3(I_1 + I_{1mother})}{2\bar{I}_{1(father+mother)}} + \frac{0.2(I_{2father} + I_{2mother})}{2\bar{I}_{2(father+mother)}}$$

Where P_1 , P_2 and P_3 are coarse wool rate, wool yield, and body weight respectively.

Then from 1991, the foundation stock was rebuilt by selecting the comparatively outstanding individuals of the breeding group. A new selection index was adopted, combining the application of restricted selection indexes and increasing the improvement of wool yield. After nine generations, the use of index and planned mating, rabbit performance get further improvement, and especially wool yield improves relatively largely. The selection index at 5 months of age remained unchanged. The following other indexes were used:

$$\text{Selection index at 8 months of the age: } I_2 = \frac{0.5P_1}{\bar{P}_1} + \frac{0.35P_2}{\bar{P}_2} + \frac{0.15P_3}{\bar{P}_3}$$

$$\text{Comprehensive index: } H = \frac{0.3I_1}{\bar{I}_1} + \frac{0.4I_2}{\bar{I}_2} + \frac{0.3(I_{2father} + I_{2mother})}{2\bar{I}_{2(father+mother)}}$$

Formula of restricted selection indexes were:

$$\text{For body weight: } I = 0.3279P_1 + 0.2011P_2 - 0.05917P_3$$

$$\text{For coarse wool rate: } I = -0.203P_1 + 0.1571P_2 + 0.01876P_3$$

$$\text{For coarse wool rate and body weight: } I = -0.1789P_1 + 0.1799P_2 - 0.04765P_3$$

Where P_1 , P_2 , and P_3 are rate of coarse wool, wool yield, and body weight respectively.

RESULT AND ANALYSIS

Body conformation, growth and development

The bred wan strain coarse wool Angola rabbit has unanimous appearance. The body structure is well-balanced, careful and compact, and of medium-sized. Whole body clothing hair is fair and clear, dense but not tangled. It is soft, and rich of elasticity and gloss. Hair length changes from 7 to 12 cm, and densely covered coarse wool gathers to be outstanding at pelage. Round medium-sized head, ears stand upright, slight or little pinch hair on the peak of ear. Eyes are red, big and bright. The chest is wide and deep, it is wide and flat to be straight to carry the waist, the buttock is blunt and round. The capacity of belly is large, of elasticity, but not limp. Four limbs are strong and healthy, the standing posture is good. The skeleton is stalwart and durable, the tail is medium-sized and long, switch of tail are abundant.

As shown in Table 1, through systematic breeding of 14 generations, the body weight of the age of 5 months was equivalent to 84.2% of the adult, demonstrating that it grew

quickly relatively in the early growth phase. That average weight gain at the age of 2-5 months reached 22.1g per day, has something to do with the blood relationship with White New Zealand rabbit in this strain.

Wool production

Through systematic breeding of 14 generations, wool yield has gotten very large improvement. Wool yield at the age of 11 months is 55.8% higher than that of the foundation population, and average generation progression is 3.99%.

Data in the Table 3 show that rate of coarse wool at the age of 11 months is 48.0% higher than that of foundation group, and the average generation progress is 3.43%.

As shown in the Table 4, there is no distinct difference at the different breeding stage for the performance of hair fibre. This shows that the hair quality is not affected while improving wool yield and rate of coarse wool simultaneously during breeding.

Reproductive performance

As shown in table 5, breeding performance of Wan strain coarse wool Angora rabbit demonstrates the steadily increasing trend. This is explained while improving the main performance (wool yield, rate of coarse wool) by a large margin, reproductive performance have not been restrained to full play.

DISCUSSION AND CONCLUSION

The crossbreeding is the important way to produce new breed of animal and poultry. The research breaks through hair rabbit breeding routine and selects domestic rabbits for parent strain, German Angora and White New Zealand rabbit which are different from purpose. Adopting the crossbreeding method among strains, produce the new strain of the coarse wool producing angola rabbit. The result indicates that this method and way are correct. The formation of this strain rabbit has made several fine traits, difficult to consider simultaneity in hair rabbit breeding, combine together for the first time, broken the already existing gene combination, coordinated the relevant relation among the properties, made hereditary foundation rich, and solved difficult problem of improvement of wool yield and rate of coarse wool concurrently in hair rabbit breeding. So, the high yield and high quality are of real realization.

During breeding selection, for making rate of coarse wool and wool yield get relatively heavy genetic progress, achieving the final purpose of this research, while making the breeding index, we have increased the weight of coarse hair rate and wool yield. In addition, adjust the main breeding goals of different stages through the change of the weight coefficient in the index. Especially through combination of the selection index with restricted selection index and utilization alternately, stress the improvement of the main properties even more.

Systematic breeding results for generations show: wool yield and rate of coarse wool have improved to the most extent, secondly growth performance receives sure improvement, especially growth rate in earlier stage have made improvement obviously. It is steadily increasing to reproduction performance at the same time.

Table 1. Growth performances and body dimensions (mean \pm standard deviation) of Wan strain coarse wool Angora rabbit at 5, 8 and 11 months for every stage and progress generation (%) at 11 months of age.

Stage	Trait	2 months	5 months	8 months	11 months	Number of Generations Progress
1987	Body weight (g)				3833 \pm 102	
1991	Body weight (g)	1376 \pm 61	3222 \pm 116	3734 \pm 109	3912 \pm 113	5
	Body length (cm)	29.9 \pm 0.8	46.3 \pm 0.6	48.7 \pm 0.8	49.4 \pm 0.5	
	Chest girth (cm)	20.3 \pm 0.7	30.0 \pm 1.3	31.5 \pm 0.9	33.1 \pm 0.6	
1995	Body weight (g)	1542 \pm 166	3361 \pm 310	3906 \pm 320	4117 \pm 293	5
	Body length (cm)	30.8 \pm 3.3	47.2 \pm 4.1	49.9 \pm 3.8	50.8 \pm 3.4	
	Chest girth (cm)	21.8 \pm 2.5	29.8 \pm 2.78	31.8 \pm 2.6	33.0 \pm 2.3	
2000	Body weight (g)	1574 \pm 134	3583 \pm 283	4087 \pm 280	4258 \pm 256	4
	Body length (cm)	32.6 \pm 2.8	48.45 \pm 3.8	51.0 \pm 3.6	51.9 \pm 3.2	
	Chest girth (cm)	22.6 \pm 1.5	28.7 \pm 2.1	32.3 \pm 2.6	33.5 \pm 3.0	

Table 2. Wool yield (g) (mean \pm standard deviation) at 5, 8 and 11 months for each stage.

stage	n	5 months	8 months	11 months	number of generation progress at 11 months(%)
1987	55			188.8 \pm 28.9	
1991	122	160.2 \pm 7.6	187.5 \pm 15.9	206.5 \pm 16.4	5
1995	114	176.1 \pm 19.5	223.1 \pm 19.8	253.2 \pm 20.2	5
2000	120	198.2 \pm 19.9	259.5 \pm 28.2	294.3 \pm 26.7	4

Table 3. Coarse wool rate (mean ± SD) at 5, 8 and 8 months for every stage.

Stage	N	5 months (%)	8 months (%)	11 months (%)	Generation	Generation progression at 11 months(%)
1987	35			10.77 ± 2.93		
1991	70	11.30 ± 1.39	12.84 ± 1.15	13.69 ± 1.18	5	5.42
1995	114	11.49 ± 1.95	13.72 ± 1.60	15.14 ± 1.66	5	2.12
2000	85	11.62 ± 1.32	13.96 ± 1.44	15.94 ± 1.49	4	1.06

Table 4. Fibre characteristics (mean ± SD) at the age of 11 months in the Wan strain coarse wool Angora rabbit.

Stage	Coarse wool				Fine wool			
	Length(cm)	Fineness(um)	Intensity(g)	Stretched length (%)	Length(cm)	Fineness(um)	Intensity(g)	Stretched length (%)
1991	N=70 11.39 ± 1.38	N=70 44.16 ± 2.98	N=20 23.20 ± 3.09	N=20 46.20 ± 2.72	N=65 7.21 ± 0.93	N=65 14.91 ± 2.19	N=20 4.23 ± 1.07	N=20 45.67 ± 2.47
1995	N=33 11.49 ± 1.37	N=33 45.12 ± 2.96	N=20 23.47 ± 2.17	N=20 46.72 ± 3.08	N=33 7.40 ± 0.89	N=33 14.86 ± 1.39	N=20 4.23 ± 0.50	N=20 44.97 ± 2.59
2000	N=50 11.55 ± 1.29	N=50 47.04 ± 3.76	N=20 24.83 ± 2.76	N=20 47.33 ± 2.84	N=50 7.36 ± 0.81	N=50 15.64 ± 0.98	N=20 4.83 ± 0.52	N=20 45.37 ± 3.18

Table 5. Mean (± SD) reproductive performances in primiparous Wan strain coarse wool Angora rabbit

Stage	Litter number	Total litter size	Lived born	Litter weight (g)	Lactating litter size	Litter weight at		Weaning Survival rate (%)	Fertility rate (%)
						21 days (g)	42 days(g)		
1991	40	6.88 ± 1.93	6.62 ± 1.71	337 ± 80	6.19 ± 1.53	2093 ± 490	4824 ± 1128	92.56	68.09
1995	130	7.06 ± 1.57	6.63 ± 1.36	349 ± 60	6.22 ± 1.09	2168 ± 363	4901 ± 833	90.84	69.52
2000	96	7.21 ± 1.45	6.82 ± 1.57	363 ± 78	6.41 ± 1.19	2244 ± 406	5027 ± 966	91.72	75.36